NE-1080

What is claimed is:

1. An optical network comprising:

a first optical switch for connecting a plurality of input ports to a plurality of output ports in response to a control message;

a second optical switch for connecting a plurality of input ports to a plurality of output ports in response to said control message;

a plurality of optical transmission links for connecting the output ports of the first optical switch to the input ports of the second optical switch;

at least one optical transmission element disposed in said optical transmission links for establishing a plurality of logical channels from said plurality of input ports of the first optical switch to said plurality of output ports of the second optical switch; and

a controller associated with said optical transmission element, the controller including a memory and creating an entry in the memory for each of said logical channels in response to said control message for mapping at least one attribute of said each logical channel to a reference optical intensity value,

said controller measuring optical intensity of each of said transmission links and comparing the measured optical intensity with the reference optical intensity value mapped in said memory to the logical channel established through said measured transmission link for management of said optical transmission element.

2. The optical network of claim 1, wherein said controller calculates a total sum of reference optical intensity values mapped in said memory to a plurality of logical channels established through said each

transmission link and compares the measured optical intensity with said total sum for management of said optical transmission element.

3. The optical network of claim 1, wherein said at least one attribute represents one of wavelength, transmission rate and data format.

4. The optical network of claim 1, wherein said controller revises said entry in response to a control message indicating a revision of said at least one attribute.

5. The optical network of claim 1, wherein said controller deletes said entry from said memory in response to a control message indicating a release of a logical channel, and wherein said first and second optical switches respond to the control message for clearing said logical channel.

6. The optical network of claim 1, wherein said controller detects a fault in said optical transmission element based on the measured optical value and a reference optical intensity value mapped in said memory.

7. The optical network of claim 1, wherein said optical transmission element comprises a wavelength division multiplexer for multiplexing optical signals from a plurality of optical links from said first optical switch into an optical multiplex signal.

8. The optical network of claim 1, wherein said optical transmission element comprises a wavelength division demultiplexer for demultiplexing an optical multiplex signal into a plurality of optical

component signals.

9. The optical network of claim 1, wherein said optical transmission element comprises an optical amplifier.

10. The optical network of claim 7, wherein said wavelength division multiplexer further comprises:

a plurality of optical variable attenuators for controlling intensity of a plurality of incoming optical signals from said first optical switch; and

a plurality of optical intensity detectors for producing a plurality of signals indicating intensity of said incoming optical signals,

said controller controlling each of said optical variable attenuators according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

11. The optical network of claim 10, wherein said controller uses said difference for detecting a fault in one of a plurality of input circuits of said wavelength division multiplexer.

12. The optical network of claim 11, wherein said wavelength division multiplexer further comprises an output optical detector for producing a signal indicating intensity of an optical multiplex signal from said multiplexer, and wherein said controller uses the signal from the output optical detector as said measured optical intensity and detects a difference between the reference optical intensity and the measured optical intensity for detecting a fault in an output circuit of said wavelength division multiplexer.

13. The optical network of claim 8, wherein said wavelength division demultiplexer further comprises:

a plurality of optical variable attenuators for controlling intensity of optical component signals; and

a plurality of output optical detectors for producing signals respectively indicating intensity of said optical component signals,

said controller controlling said variable attenuators according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

14. The optical network of claim 13, wherein said wavelength division demultiplexer further comprises an input optical detector for producing a signal indicating intensity of said optical multiplex signal, and wherein said controller uses said difference for detecting a fault in an input circuit of said wavelength division demultiplexer.

15. The optical network of claim 9, wherein said optical amplifier comprises:

an optical amplifying medium for amplifying an optical multiplex signal;

an excitation energy source for pumping optical energy into the optical amplifying medium;

an input optical detector for producing a signal indicating intensity of an optical multiplex signal supplied to said optical amplifying medium, and

an output optical detector for producing a signal indicating intensity of the amplified optical multiplex signal from said optical amplifying medium,

said controller controlling said excitation energy source according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

16. The optical network of claim 1, wherein said at least one transmission element comprises a wavelength division multiplexer, an optical amplifier and a wavelength division demultiplexer connected in series in said optical transmission links, and wherein said controller is one of a plurality of first, second and third controllers associated with said multiplexer, said amplifier and said demultiplexer, respectively.

17. The optical network of claim 16, wherein said control message is a multicast message transmitted over a common channel to said first and second optical switches and to said first, second and third controllers.

18. An optical network element comprising:

an optical transmission element disposed in a plurality of optical links for establishing a plurality of logical channels in said optical links;

monitoring circuitry for detecting an optical intensity of each of said optical links;

a management table for defining a plurality of entries corresponding to said logical channels, each of said entries mapping at least one attribute of the corresponding logical channel to a reference optical intensity value; and

a controller for creating an entry in said management table for each of said logical channels in response to said control message for mapping at least one attribute of said each logical channel to a reference optical intensity value,

said controller measuring optical intensity of each of said optical links and comparing the measured optical intensity with the reference optical intensity value mapped in said management table to the logical channel established through the measured optical link for management of said optical transmission element.

19. The optical network element of claim 18, wherein said controller calculates a total sum of reference optical intensity values mapped in said management table to a plurality of logical channels established through said measured optical link and compares the measured optical intensity with said total sum for management of said optical transmission element.

20. The optical network element of claim 18, wherein said at least one attribute represents one of wavelength, transmission rate and data format.

21. The optical network element of claim 18, wherein said optical transmission element is a wavelength division multiplexer.

22. The optical network element of claim 18, wherein said optical transmission element is a wavelength division demultiplexer.

23. The optical network element of claim 18, wherein said optical transmission element is an optical amplifier.

24. The optical network of claim 20, wherein said wavelength

division multiplexer further comprises:

a plurality of optical variable attenuators for controlling intensity of a plurality of incoming optical signals from said first optical switch; and

a plurality of optical intensity detectors for producing a plurality of signals indicating intensity of said incoming optical signals,

said controller controlling each of said optical variable attenuators according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

25. The optical network of claim 24, wherein said controller uses said difference for detecting a fault in one of a plurality of input circuits of said wavelength division multiplexer.

26. The optical network of claim 25, wherein said wavelength division multiplexer further comprises an output optical detector for producing a signal indicating intensity of an optical multiplex signal from said multiplexer, and wherein said controller uses the signal from the output optical detector as said measured optical intensity and detects a difference between the reference optical intensity and the measured optical intensity for detecting a fault in an output circuit of said wavelength division multiplexer.

27. The optical network of claim 22, wherein said wavelength division demultiplexer further comprises:

a plurality of optical variable attenuators for controlling intensity of optical component signals; and

a plurality of output optical detectors for producing signals respectively indicating intensity of said optical component signals,

said controller controlling said variable attenuators according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

28. The optical network of claim 27, wherein said wavelength division demultiplexer further comprises an input optical detector for producing a signal indicating intensity of said optical multiplex signal, and wherein said controller uses said difference for detecting a fault in an input circuit of said wavelength division demultiplexer.

29. The optical network of claim 23, wherein said optical amplifier comprises:

an optical amplifying medium for amplifying an optical multiplex signal;

an excitation energy source for pumping optical energy into the optical amplifying medium;

an input optical detector for producing a signal indicating intensity of an optical multiplex signal supplied to said optical amplifying medium, and

an output optical detector for producing a signal indicating intensity of the amplified optical multiplex signal from said optical amplifying medium,

said controller controlling said excitation energy source according to a difference between the measured optical intensity and said reference intensity value mapped in said memory.

30. A management method for an optical transmission element connected in a plurality of optical transmission links which accommodate a

plurality of logical channels, the method comprising the steps of:

creating an entry in a memory in response to a control message for mapping at least one attribute of a logical channel accommodated in one of said transmission links to a reference optical intensity value;

measuring optical intensity of each of said optical transmission links;

comparing the detected optical intensity with the reference optical intensity mapped in said memory to at least one logical channel accommodated in said measured optical transmission link; and

controlling said optical transmission element according to a result of the comparison step.

31. The management method of claim 30, wherein the comparison step further comprises calculating a total sum of reference optical intensity values mapped in said memory to a plurality of logical channels established through said measured transmission link and compares the measured optical intensity with said total sum for management of said optical transmission element.

32. The management method of claim 30, wherein said at least one attribute represents one of wavelength, transmission rate and data format.

33. The management method of claim 30, further comprising the step of adjusting optical intensity level of each of said transmission links based on a result of the comparison step.

34. The management method of claim 30, further comprising the step of detecting a fault in said optical network element based on a result of

the comparison step.

35. The management method of claim 30, wherein the comparison step comprises calculating a total value of reference optical intensity values mapped in said memory to a plurality of logical channels accommodated in said measured transmission link and comparing the measured intensity with said total value.

36. A control method for an optical communication network in which at least one optical transmission element is disposed in a plurality of optical transmission links which accommodate a plurality of logical channels, between a first optical switch and a second optical switch, the method comprising the steps of:

transmitting a setup message from a transmit site;

establishing a connection in said first optical switch in response to said setup message and a connection in said second optical switch in response to said setup message;

creating an entry in a memory in response to said control message for mapping at least one attribute of a logical channel accommodated in one of said transmission links to a reference optical intensity value;

measuring optical intensity of each of said optical transmission links;

comparing the detected optical intensity with the reference optical intensity mapped in said memory to at least one logical channel accommodated in said measured optical transmission link; and

controlling said optical transmission element according to a result of the comparison step.

37. The control method of claim 36, wherein the comparison step comprises the steps of:

calculating a total value of reference optical intensity values mapped in said memory to a plurality of logical channels accommodated in said measured transmission link; and

comparing the measured intensity with said total value.

38. The control method of claim 36, further comprising the steps of:

transmitting a modify message from said transmit site; and

modifying said at least one attribute according to the modify message.

39. The control method of claim 36, further comprising the steps of:

transmitting a release message from said transmit site; and

responsive to said release message, clearing said connections from the first and second optical switches and deleting said entry from said memory.